

WHAT IS CLAIMED IS:

1. A print position adjusting method of using a print head having a plurality of arranged nozzles from which ink  
5 is ejected to a print medium, to perform alternately a printing operation of scanning the print head in a predetermined direction different from a direction in which said plurality of nozzles are arranged, to eject ink from said nozzles to a print medium during the scan, and a paper  
10 feeding operation of relatively moving said print medium and said print head a distance corresponding to a predetermined movement pitch in a direction different from the scanning direction of said print head, said print head being scanned over said print medium by reciprocating in  
15 said predetermined direction, to enable bidirectional printing in which said printing operation is performed during both a forward scan and a backward scan, said method comprising:

a plurality modes having different dot arrangements  
20 for a scan of said print head;

a mode selecting step of selecting one of the plurality of print modes;

a determining step of determining an adjustment value that varies a drive timing for said plurality of nozzles  
25 between said forward scan and said backward scan in accordance with the print mode selected in the mode selecting step; and

a printing step of performing said printing operation using the drive timing for said nozzles determined on the basis of said adjustment value determined in said determining step.

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2. A print position adjusting method as claimed in Claim 1, wherein said plurality of print modes include a multipass print mode in which a printing operation is performed both during the forward scan of said print head and during the backward scan of said print head and in which said movement pitch during said paper feeding operation is smaller than an arrangement pitch of the nozzles in said print head, and

said determining step uses different adjustment values in the multipass print mode and in the other print modes.

3. A print position adjusting method as claimed in Claim 1, wherein impact positions of dots formed by ink droplets ejected from the nozzles driven using a drive timing based on said adjustment value differ from impact positions of dots formed by ink droplets ejected from the nozzles driven using a drive timing not based on said adjustment value.

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4. A print position adjusting method as claimed in Claim 2, wherein in said determining step, in the print

modes other than said multipass print mode, the adjustment value comprises an adjustment value determined in said multipass print mode plus a predetermined correction value.

5           5. A print position adjusting method as claimed in Claim 1, wherein said determining step selects an optimum one of a plurality of print patterns obtained by ejecting ink using different nozzle drive timings and sets said adjustment value to be a drive timing with which the selected  
10 print pattern is printed.

          6. A print position adjusting method as claimed in Claim 5, wherein said plurality of print patterns are obtained by varying time required after ink has been ejected  
15 from an even-number-th nozzle in a nozzle arrangement direction and before ink is ejected from a corresponding odd-number-th nozzle in the nozzle arrangement direction and varying ejection timings during the forward and backward scans.

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          7. A print position adjusting method as claimed in Claim 1, wherein said plurality of modes include a plurality of drive modes having different time intervals at which ink is ejected from said nozzles to the print medium, and  
25           said determining step uses as the adjustment reference value an adjustment value determined for a first drive mode, and if any of the drive modes other than said first drive

mode is selected, uses as the adjustment value said adjustment reference value plus a predetermined correction value.

5           8. An ink jet printing apparatus that uses a print head having a plurality of arranged nozzles from which ink is ejected to a print medium, to perform alternately a printing operation of scanning the print head in a predetermined direction different from a direction in which  
10 said plurality of nozzles are arranged, to eject ink from said nozzles to a print medium during the scan, and a paper feeding operation of relatively moving said print medium and said print head a distance corresponding to a predetermined movement pitch in a direction different from  
15 the scanning direction of said print head, said print head being scanned over said print medium by reciprocating in said predetermined direction, to enable bidirectional printing in which said printing operation is performed during both a forward scan and a backward scan, said apparatus  
20 comprising:

          a plurality of modes having different dot arrangements for a scan of said print head;

          mode selecting means for selecting one of the plurality of print modes;

25           determining means for determining an adjustment value that varies a drive timing for said plurality of nozzles between said forward scan and said backward scan in

accordance with the print mode selected by the mode selecting means; and

printing means for performing said printing operation using the drive timing for said nozzles determined on the basis of said adjustment value determined by said determining means.

9. An ink jet printing apparatus as claimed in Claim 8, wherein said plurality of print modes include a multipass print mode in which a printing operation is performed both during the forward scan of said print head and during the backward scan of said print head and in which said movement pitch during said paper feeding operation is smaller than an arrangement pitch of the nozzles in said print head, and

said determining means uses different adjustment values in the multipass print mode and in the other print modes.

10. An ink jet printing apparatus as claimed in Claim 9, further comprising creating means for creating a plurality of adjustment patterns by driving said nozzles while varying a drive timing for said nozzles, and

wherein said determining means selects one of the adjustment patterns created by said creating means and determines a reference value for said adjustment value on the basis of a drive timing with which the selected pattern

is created so that in said multipass print mode, said reference value is used as said adjustment value, whereas in the print modes other than said multipass print mode, said reference value plus a predetermined correction value  
5 is used as said adjustment value.

11. An ink jet printing apparatus as claimed in Claim 10, wherein said print modes further include a unidirectional print mode in which a printing operation  
10 is performed only during the forward scan and a bidirectional print mode in which a printing operation is performed both during the forward scan of said print head and during the backward scan of said print head, and

said determining means determines that said adjustment  
15 value on bidirectional print mode is said adjustment reference value plus a predetermined correction value, and said adjustment value on unidirectional print mode is said adjustment reference.

20 12. An ink jet printing apparatus as claimed in Claim 8, wherein each of said nozzles ejects a main droplet that is an ink droplet forming a main dot and a satellite droplet that forms a satellite dot near said main dot, the satellite dot having a smaller dot diameter than said main dot, and  
25 an impact position of said satellite droplet varying between the forward scan and backward scan of said print head, and  
said determining means determines said adjustment

value so that in connection with a high-density portion formed on the print medium by said printing means and composed of said main dots and said satellite dots, the high-density portion formed during the forward scan is adjacent to the high-density portion formed during the backward scan, in a scan direction of the print head.

13. An ink jet printing apparatus as claimed in Claim 8, wherein said print head uses thermal energy to generate bubbles in ink so that pressure generated by the bubbles causes the ink to be ejected as droplets.

14. An ink jet printing apparatus as claimed in Claim 8, wherein said plurality of modes include a plurality of drive modes having different time intervals at which ink is ejected from said nozzles to the print medium, and said determining means uses as the adjustment reference value an adjustment value determined for a first drive mode, and if any of the drive modes other than said first drive mode is selected, uses as the adjustment value said adjustment reference value plus a predetermined correction value.

15. An ink jet printing system composed of a print position adjusting apparatus that uses a print head having a plurality of arranged nozzles from which ink is ejected to a print medium, to perform alternately a printing

operation of scanning the print head in a predetermined direction different from a direction in which said plurality of nozzles are arranged, to eject ink from said nozzles to a print medium during the scan, and a paper feeding operation of relatively moving said print medium and said print head a distance corresponding to a predetermined movement pitch in a direction different from the scanning direction of said print head, said print head being scanned over said print medium by reciprocating in said predetermined direction, to enable bidirectional printing in which said printing operation is performed during both a forward scan and a backward scan; and a host computer connected to the ink jet printing apparatus, said system comprising:

15 a plurality modes having different dot arrangements for a scan of said print head;

mode selecting means for selecting one of the plurality of print modes;

determining means for determining an adjustment value that varies a drive timing for said plurality of nozzles between said forward scan and said backward scan in accordance with the print mode selected by the mode selecting means; and

20 printing means for driving said nozzles in accordance with the drive timing for said nozzles determined on the basis of said adjustment value determined by said determining means.

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16. An ink jet printing system as claimed in Claim 15, wherein said plurality of print modes include a multipass print mode in which a printing operation is performed both during the forward scan of said print head and during the backward scan of said print head and in which said movement pitch during said paper feeding operation is smaller than an arrangement pitch of the nozzles in said print head,

said system further comprises creating means for creating a plurality of adjustment patterns by driving said nozzles while varying a drive timing for said nozzles,

said host computer comprises adjustment pattern selecting means for transmitting one of said adjustment pattern which is selected by the user, to said ink jet printing apparatus, and

said determining means selects one of the adjustment patterns created by said creating means and determines a reference value for said adjustment value on the basis of a drive timing with which the selected pattern is created so that during said paper feeding operation, in said multipass print mode, said reference value is used as said adjustment value, whereas in the print modes other than said multipass print mode, said reference value plus a predetermined correction value is used as said adjustment value.